Understanding the Alternator

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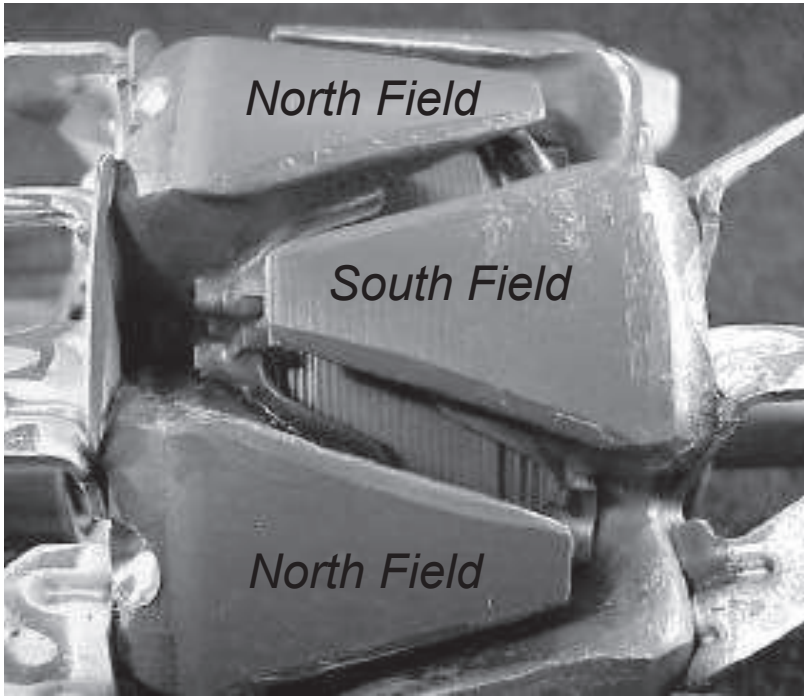
Alternating Magnetic Field



- The rotor field winding creates the magnetic field that induces voltage into the stator.
- The magnetic field is saturates the iron finger poles. One finger pole become a north pole and the other a south pole.
- The rotor spins creating an alternating magnetic field, North, South, North, South, etc.

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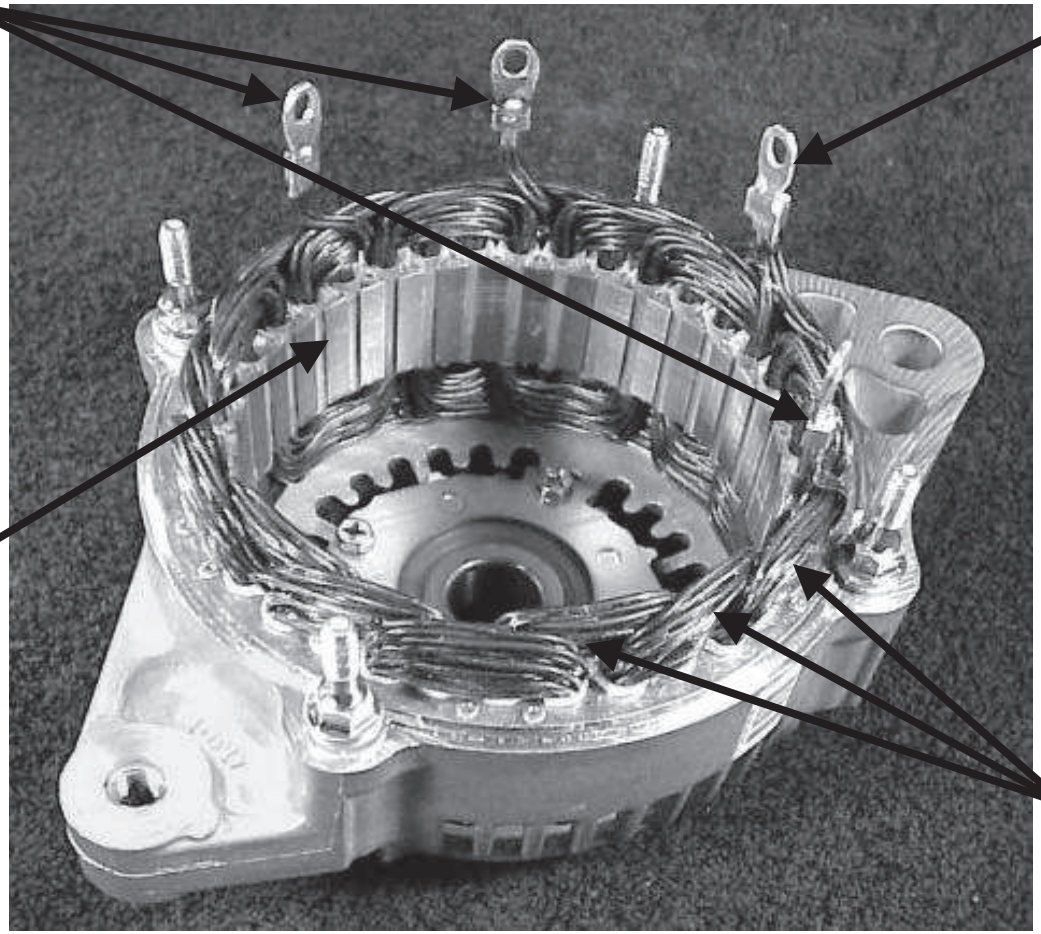
Stator Winding



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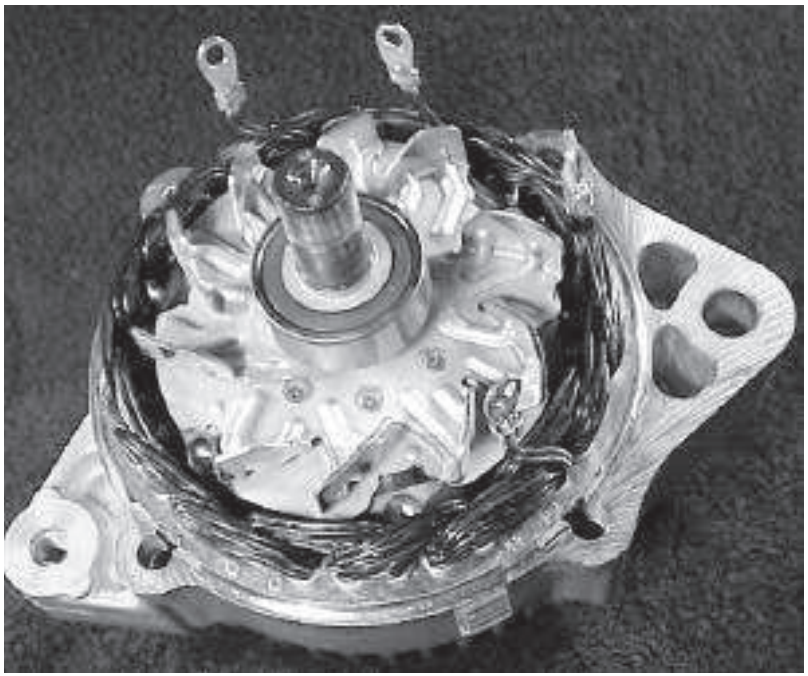
Rotor / Stator Relationship



- As the rotor assembly rotates within the stator winding.
- The alternating magnetic field from the spinning rotor induces an alternating voltage into the stator winding.
- The strength of the magnetic field and the speed of the rotor affect the amount of voltage induced into the stator.

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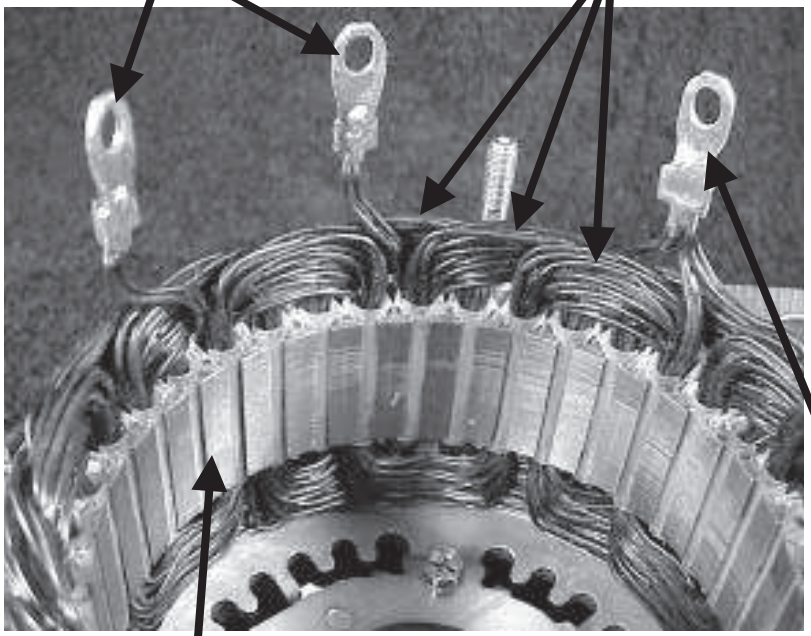
Stator Windings



- The stator is made with three sets of windings.
- Each winding is placed is a different position compared with the others.
- A laminated iron frame concentrates the magnetic field.
- Stator lead ends that output to the diode rectifier bridge.

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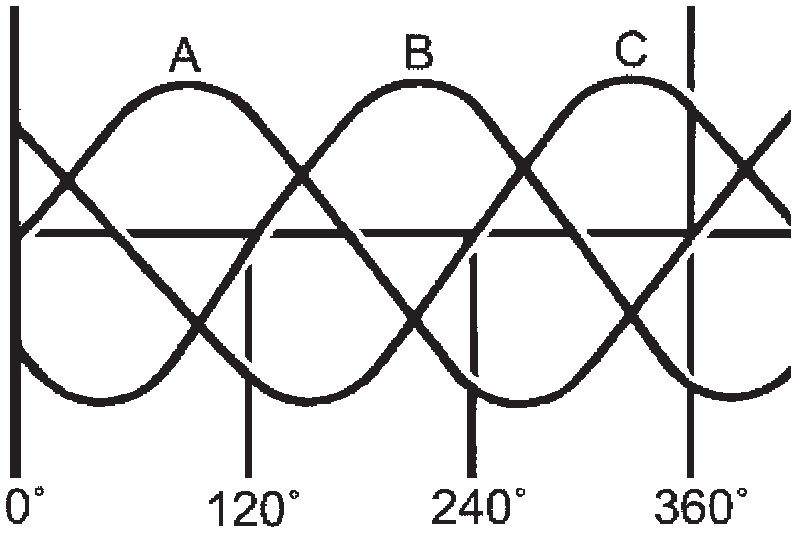
3 Phase Windings



- The stator winding has three sets of windings. Each is formed into a number of evenly spaced coils around the stator core.
- The result is three overlapping single phase AC sine wave current signatures, A, B, C.
- Adding these waves together make up the total AC output of the stator. This is called three phase current.
- Three phase current provides a more even current output.

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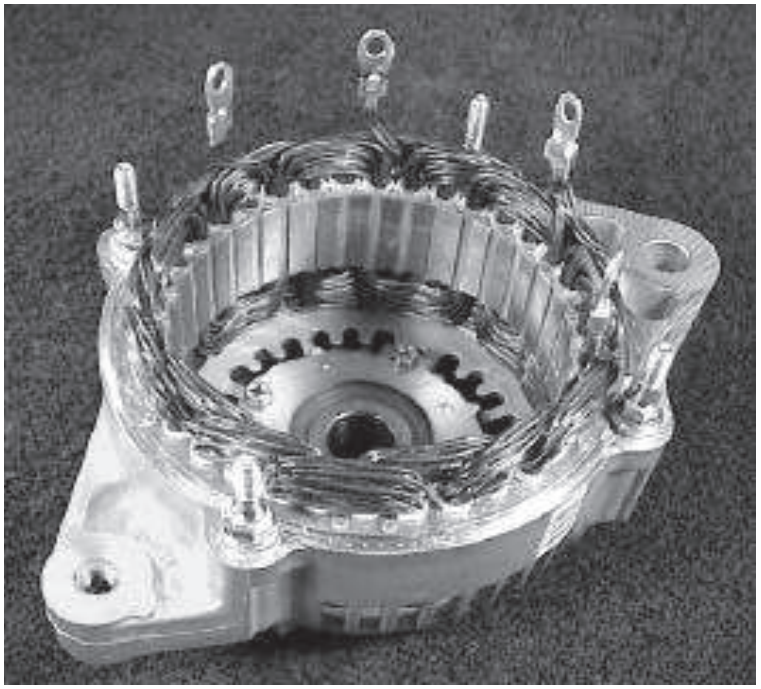
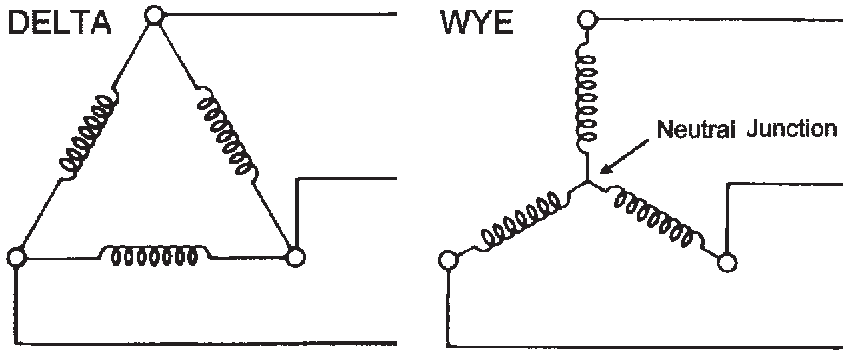
Stator Design



Two designs of stator winding are used. Delta and Wye.

Delta wound stators can be identified by having only three stator leads, and each lead will have the same number of wires attached.



Wye style has four stator leads. One of the leads is called the Neutral Junction. The Neutral Junction is common to all the other leads.

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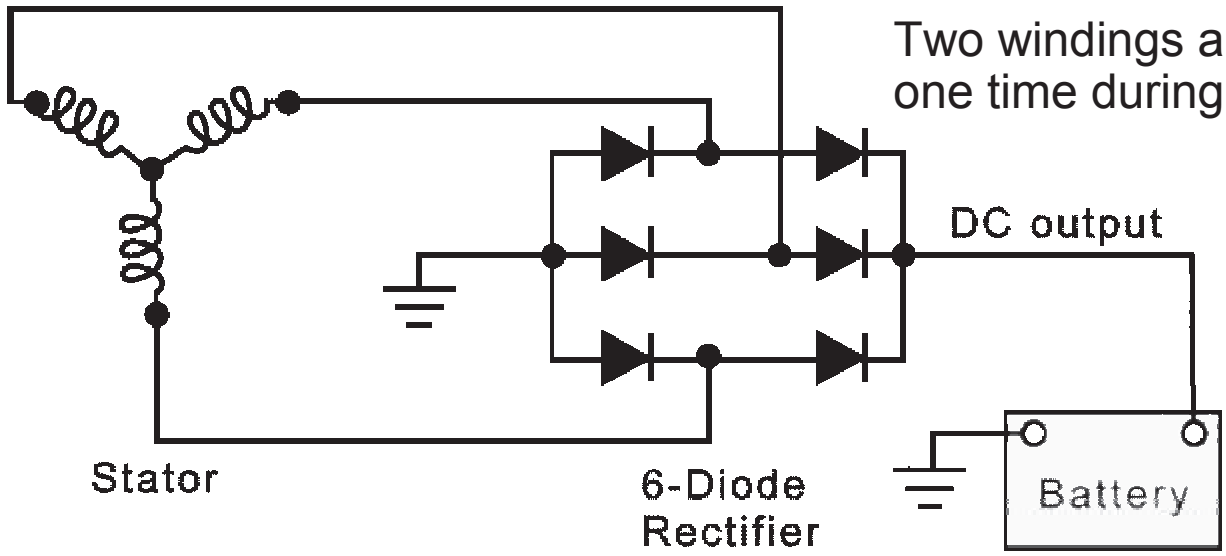
Wye Design

Wye wound stators have three windings with a common neutral junction. They can be identified because they have 4 stator lead ends.

Wye wound stators are used in alternators that require high voltage output a low alternator speed.

Two windings are in series at any one time during charge output.



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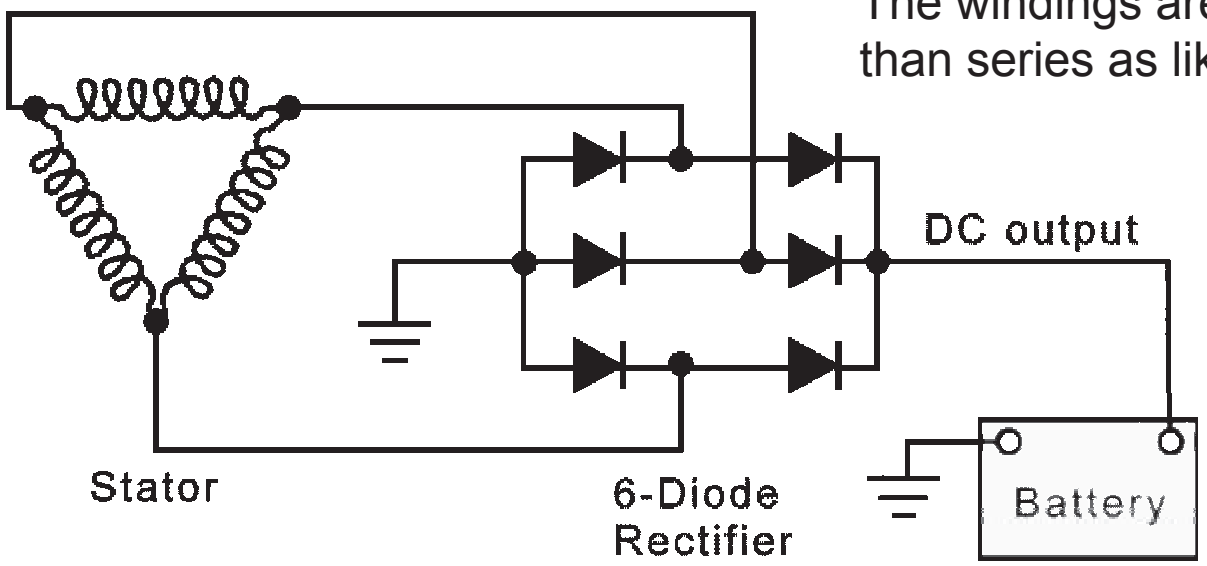
Delta Design

Delta wound stators can be identified because they have only three stator lead ends.

Delta stators allow for higher current flow being delivered at low RPM.

The windings are in parallel rather than series as like the Wye design.



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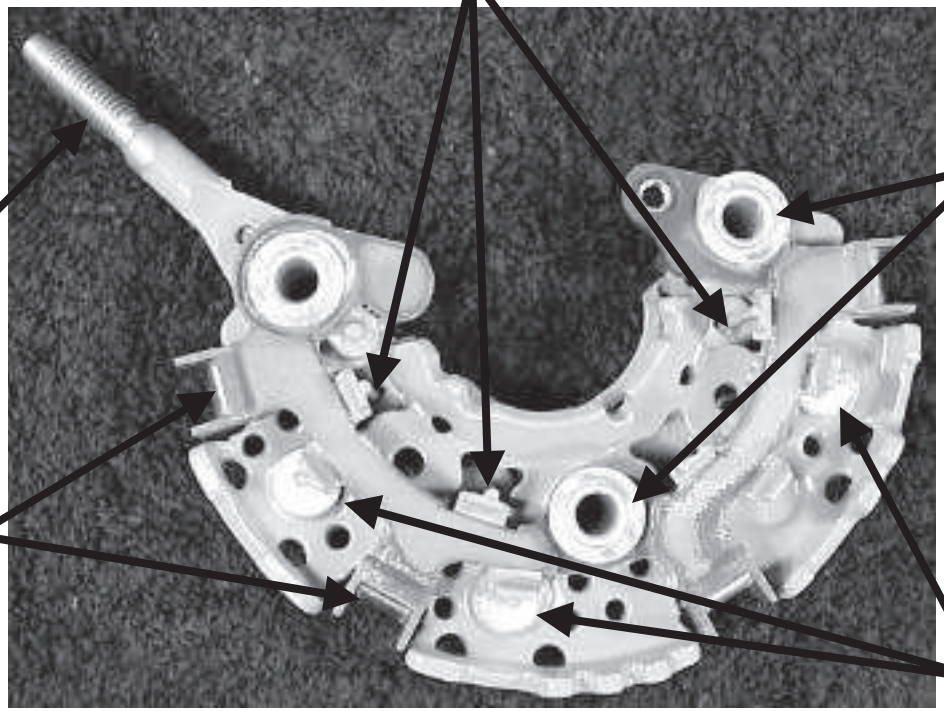
Diode Rectifier Bridge Assembly



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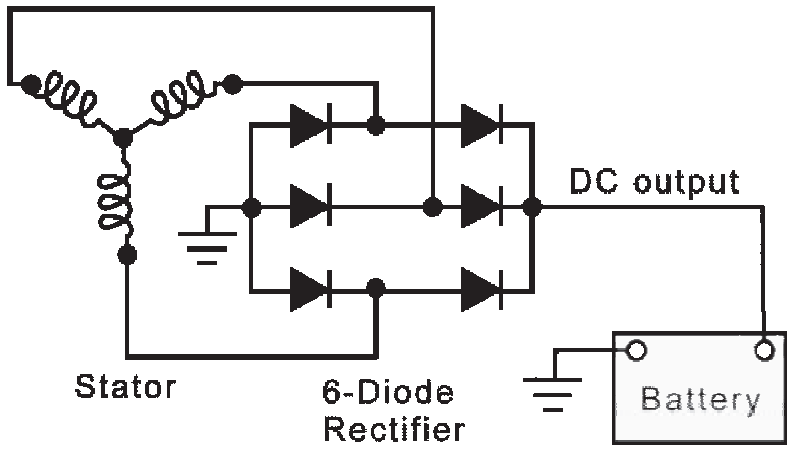
Rectifier Operation



The Diode Rectifier Bridge is responsible for for the conversion or rectification the AC voltage into DC voltage.

- Two diodes are connected to each stator lead. One positive the other negative.
- Because a single diode will only block half the the AC voltage.
- Six or eight diodes are used to rectify the AC stator voltage to DC voltage.
- Diodes used in this configuration will redirect both the positive and negative polarity signals of the AC voltage to produce DC voltage. This process is called ‘Full - Wave Rectification’.

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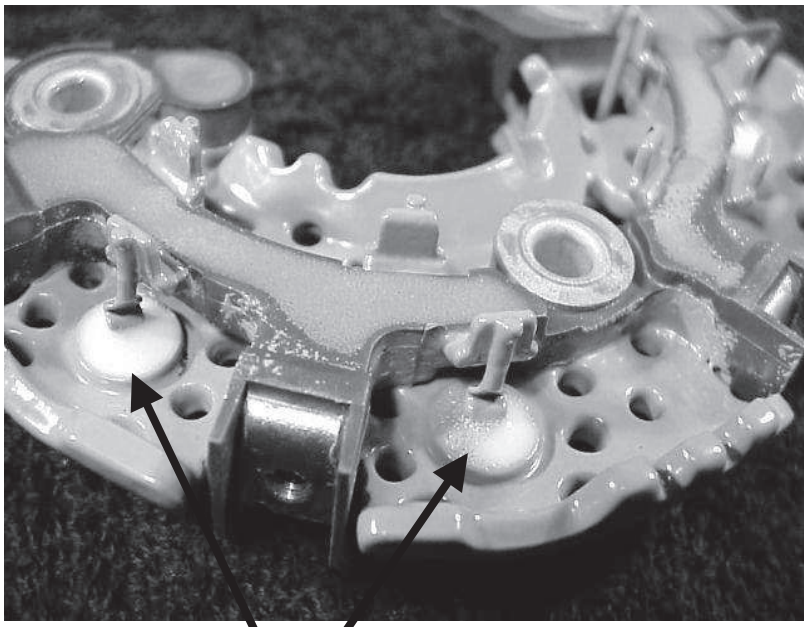
Diodes



Diodes

- Diodes are used as one-way electrical check valves. Passing current in only one direction, never in reverse.
- Diodes are mounted in a heat sink to dissipate the heat generated by the diodes.
- Diodes redirect the AC voltage into DC voltage so the battery receives the correct polarity.

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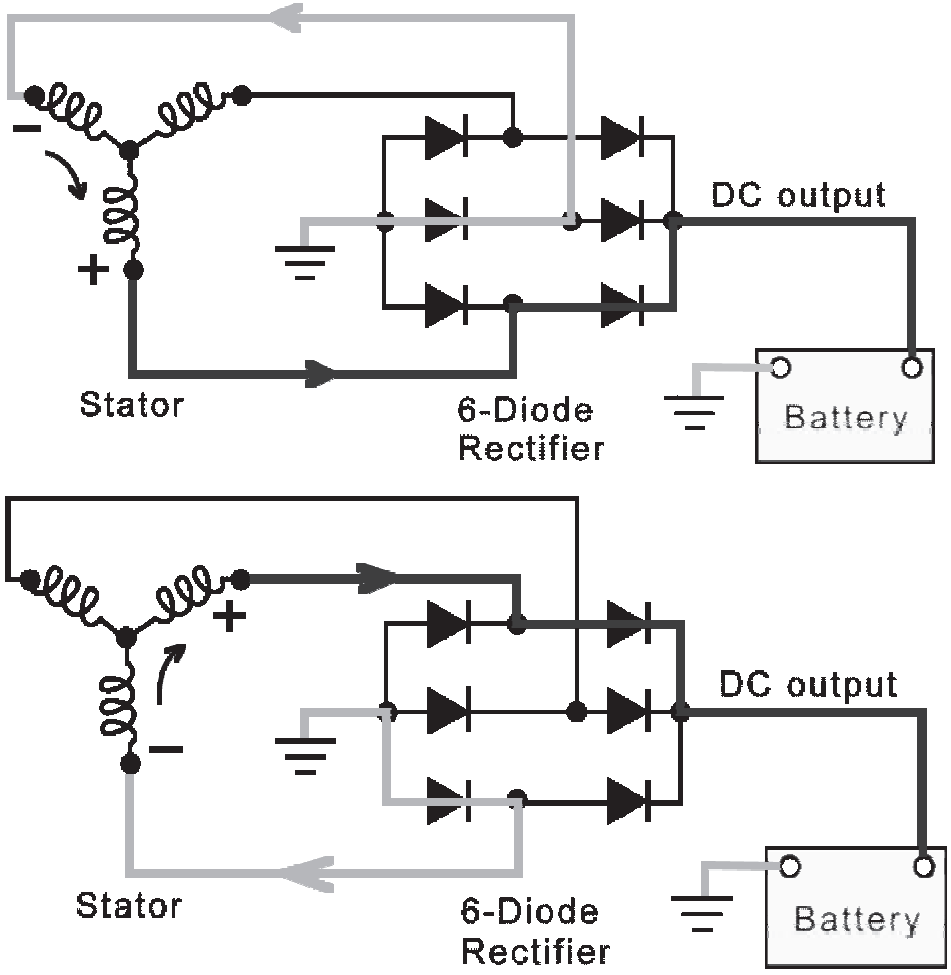
Rectifier Operation



In red you can see B+ current pass through to the rectifier as it goes to the battery. In green you can see the return path.

Now, in red B+ current passes through to the rectifier however, this time current has the opposite polarity. In green you can see the new return path.

Even though it enters the rectifier at a different location, current goes to the battery in the same direction.

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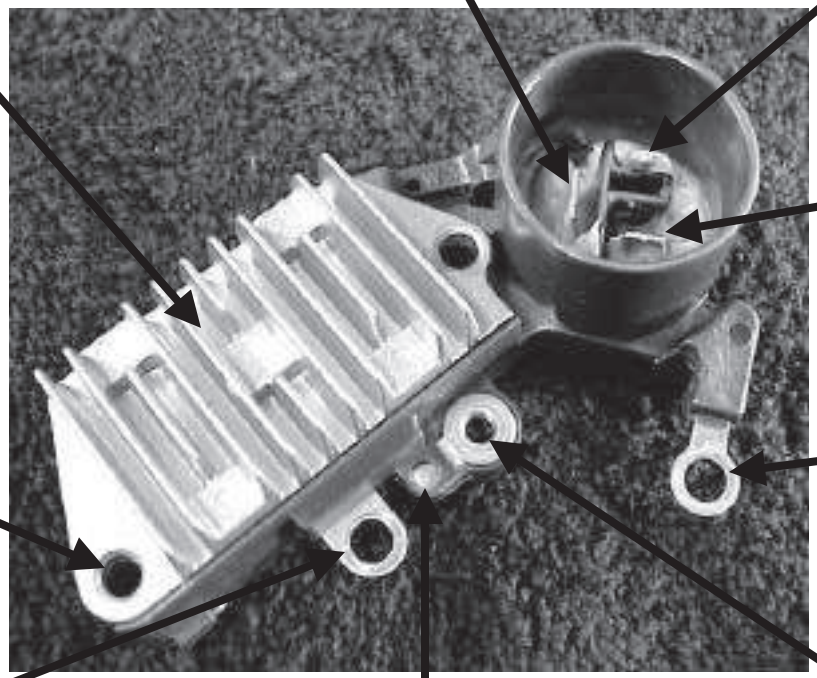
Electronic Regulator



Heat Sink

"S" Terminal
Senses Battery Voltage

"L" Terminal
Warning Lamp

"IG" Terminal
Ignition Switch Signal
Turns Regulator ON

Regulator
Ground

"B" Terminal
Connects to Alternator
Output Terminal

"P" Terminal
Senses Neutral Junction
voltage of Stator

"F" Terminal Test Pad
Full Field Test Point

"F" Terminal
Connects Regulator
to Rotor Winding

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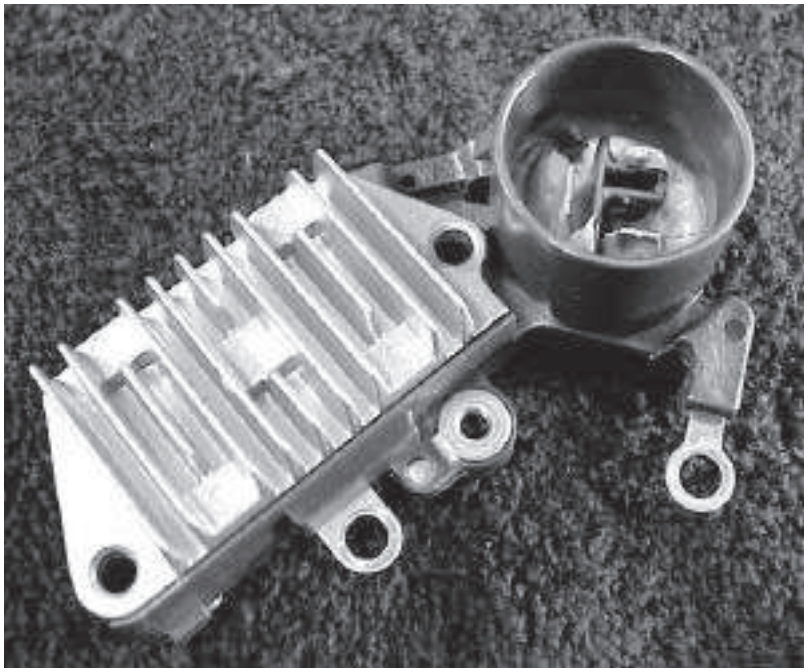
Voltage Regulation



- The regulator will attempt to maintain a pre-determined charging system voltage level.
- When charging system voltage falls below this point, the regulator will increase the field current, thus strengthening the magnetic field, which results in an increase of alternator output.
- When charging system voltage raises above this point, the regulator will decrease field current , thus weakening the magnetic field, and results in a decrease of alternator output.

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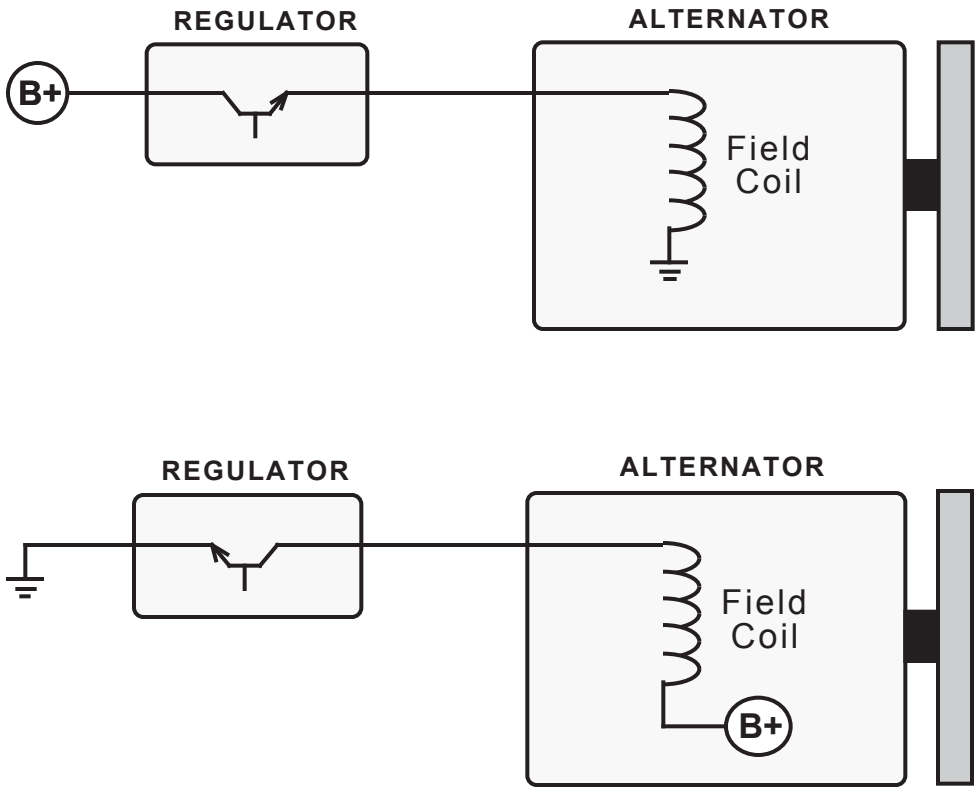
Regulator Types



- Any one of two regulator designs can be used.
- The Grounded Field type. The regulator controls the amount of B+ going to the field winding in the rotor.
- The Grounded Regulator type. The regulator controls the amount battery ground (negative) going to the field winding in the rotor.

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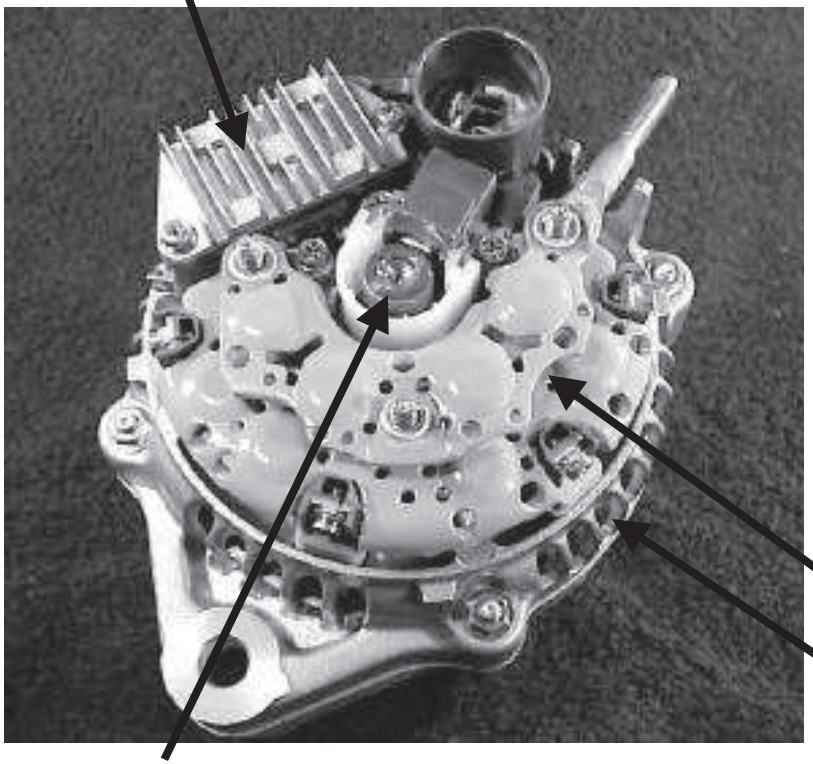
Working Alternator



The regulator monitors battery voltage.

The regulator controls current flow to the rotor assembly.

The rotor produces a magnetic field.

Voltage is induced into the stator.

The rectifier bridge converts AC stator voltage to DC output for use by the vehicle.

Diode Rectifier Bridge

Contains the Rotor & Stator

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